REMARKS

After the foregoing Amendment, claims 1 – 6, 8, 11 – 23, 25 – 26, 28 – 29, and 31 – 46 are currently pending in this application. Claims 9 – 10 are cancelled without prejudice. Claims 7, 24, and 30 were previously canceled without prejudice. Claims 1, 5, 6, 8, 11, 13, 15, 16, 18, 19, 21, 26, and 28 are amended. New claims 34 – 46 are added. Support for the amendments and new claims can be found at paragraphs 20, 47, 49, and 56 at U.S. Pre-grant publication No. 20070024295, which corresponds to the application as originally filed. Applicant submits that no new matter has been introduced into the application by these amendments.

***Claim Rejections - 35 USC* §103(a)**

Hough

The Action rejects claims 16, 26, and 28 as obvious over U.S. pre-grant application publication No. 2005/0029450 (Hough). The Action states that Hough teaches several of the claim 16 elements but admits that Hough does not refer to Q. With respect to the Q factor, the Action states that many different prior art microscopes probes would have a Q factor and all but one would have a low Q factor relative to the probe with the highest Q factor. Applicant traverses the rejection for at least the following reasons.

Applicant believes that the definition of Q factor is clearly set forth in the instant specification and the claims were distinguishable from Hough. Nonetheless,

in an earnest attempt to advance prosecution, Applicant amended claims to recite features that impart low Q and are not disclosed, taught, or suggested in any of the cited prior art references.

Claim 16, as amended, recites:

> An atomic force microscope comprising a driver; a probe having a tip, a substrate and a beam connecting the tip and the substrate; and a probe detection mechanism;
>
> at least a portion of the beam coated with a polymer and the polymer includes a rubber having a low cross-linking density
> . . .
> wherein the microscope includes a force generator arranged such that, in operation, a force is applied to either or both of the sample and the probe or between the sample and the probe, the force being directed so as to urge the probe towards the sample or vice versa

Underline added. As disclosed in the present specification, polymers having a low cross-linking density can dissipate mechanical energy:

> The material is selected for its viscous-elastic properties ... must be sufficiently elastic to maintain its shape as a film coating the cantilever, whilst performing its task of dissipating mechanical energy. ... . The ideal coating is a rubber with low cross-link density... .

Paragraph 56, underline added. Further the present specification teaches that dissipating mechanical energy and/or providing a direct biasing force towards the sample is preferable to improve scanning and image quality. Paragraphs 19 – 23.

In contrast, Hough teaches that forces bringing the probe towards the sample together must be reduced and actively overcome with a magnet forcing the probe

and sample apart. See Hough, paragraphs 51 – 52. Hough fails to suggest and teaches away from a "force being directed so as to urge the probe towards the sample or vice versa." Hough teaches away from the invention as recited in claim 16, as amended.

Claim 26, as amended, recites "the beam further comprising a hole... ." An electronic search of Hough fails to reveal that Hough contemplated placing a hole in the probe beam in order to reduce mechanical energy that might otherwise be stored in the probe.

Claim 28, as amended recites:

> The atomic force microscope as claimed in claim 16, further comprising a resonant oscillator mechanically coupled to either the probe or a sample stage for causing relative oscillatory movement between the probe and the sample with an oscillatory amplitude of at least one micrometer.

Underline added. An electronic search of Hough fails to reveal a relative oscillatory amplitude between the sample and probe on this scale.

Finally, claims 26 and 28 are dependent upon claim 16, which Applicant believes are allowable over the cited prior art of record for the same reasons provided above.

Hough fails to suggest every element of any one of claims 16, 26 or 28 and teaches away from the invention claimed. Based on the foregoing amendment and

arguments, Applicant believes that the rejections are overcome and requests withdrawal of the 35 U.S.C. 103(a) rejection of claims 16, 26, and 28 over Hough.

Shirakawabe, Hough, Minne

The Action rejects claims 1, 4 – 6, 8 – 9, and 13 – 14 as obvious over U.S. pre-grant application publication No. 2002/0179833 (Shirakawabe) in view of either i) Hough or ii) U.S. patent No. 6,886,395 (Minne). Claim 9 is cancelled and its rejection is moot. The Action states that the cantilever disclosed in Shirakawabe inherently dampens, is a dampening element, and has a coating on it. Applicant traverses the rejection for at least the following reasons.

Claim 6, as amended, recites:

> A probe for use in an atomic force microscope, the probe comprising a tip and a beam, the tip having a tip radius of 100 nm or less, the beam having a first and second side and is coated on at least one of the first and second sides with a mechanical-energy dissipating polymer.

Underline added.

As set forth in the reply to the rejection of claims 16, 26, and 28 over Hough, Hough teaches pulling the probe and sample apart. In contrast, Shirakawabe teach utilizing a magnetic force to sense a probe-sample interaction. Shirakawabe, Paragraph 34. Assuming *arguendo* that the Shirakawebe magnetic force can be regarded as a force "barely greater than that necessary for that initial [probe-sample] contact," as described by the Action, the combination with Hough would

destroy that attractive force. Instead of the probe and sample being drawn together, the conductive coating described in Shirakawabe would be utilized to actively pull the sample and probe apart upon the combination of Shirakawabe and Hough. Although the Action cites Hough for the size of tip, the reference must be considered in its entirety in the combination, including sections directly teaching away from the primary reference and the claimed invention. As set forth, Hough not only teaches away from the claimed invention, but destroys the invention described in Shirakawabe. The combination of Shirakawabe and Hough is improper.

As admitted in the Action, Shirakawabe fails to teach tip dimensions of a probe. Since the combination of Shirakawabe and Hough teaches away from the claimed invention and is improper, it is immaterial that Hough teaches any particular probe dimension.

As set forth above, Hough in fact teaches away from coating a probe with an energy dissipating polymer and Shirakawabe's conductive coating is not "a mechanical energy dissipating polymer." The combination of Shirakawabe and Hough fails to disclose or suggest a probe having a "beam having a first and second side and is coated on at least one of the first and second sides with a mechanical-energy dissipating polymer," as recited in claim 6, as amended.

With respect to the combination of Shirakawabe and Minne, Minne adds probe construction methods and Shirakawabe's conductive coating is designed to allow current flow through the probe. Shirakawabe, paragraph 34. In contrast, the specification of the present application states that the polymer coating provided on a probe performs the task "dissipating mechanical energy." Shirakawabe and Minne fail to disclose a probe coated on at least one side with a "mechanical-energy dissipating polymer," as recited in claim 6, as amended.

Finally, Shirakawabe teaches magnetic force only as the interaction force that is measured during a scan and one of ordinary skill in the art would understand that the conductive coating is utilized to generate this interaction force. One of ordinary skill in the art would not conclude that the conductive coating dissipates mechanical energy. Indeed, one of ordinary skill in the art would understand that a conductive coating could, in fact, cause retention of mechanical energy. Shirakawabe, thus, teaches away from coating a probe with a "mechanical-energy dissipating polymer," as recited in claim 6, as amended.

Claims 4 – 6, 8 – 9, and 13 – 14 are dependent upon claim 6, which Applicant believes are allowable over the cited prior art of record for the same reasons provided above.

The combinations of i) Shirakawabe and Hough or ii) Shirakawabe and Minne fail to disclose or suggest all of the elements of any one of claims 1, 4 – 6, 8 –

9, and 13 – 14. Further, Shirakawabe or Hough, alone or in combination, teach away from the claimed invention. Based on the foregoing amendment and arguments, Applicant believes that the rejections are overcome and requests withdrawal of the 35 U.S.C. 103(a) rejection of claims 1, 4 – 6, 8 – 9, 13 – 14, 16, 17, 18, 19, and 26 over i) Shirakawabe and Hough and ii) Shirakawabe and Minne.

Shirakawabe

The Action rejects claims 16, 17, 18, 19, and 26 as obvious over Shirakawabe. Applicant's discussion of Shirakawabe, above, is incorporated herein.

Shirakawabe does not have any indication that a rubber having a low cross-linking polymer could coat a probe. Indeed, Shirakawabe discloses that a "cantilever 11 with conducting material coating the tip 11a is used... ." Shirakawabe, paragraph 34. One of ordinary skill in the art would appreciate that rubber is non-conductive. Shirakawabe does not disclose or suggest a probe with "at least a portion of the beam coated with a polymer and the polymer includes a rubber having a low cross-linking density," as recited in claim 16, as amended. Indeed, by teaching "conductive material," Shirakawabe teaches away from the claimed invention.

Claims 17, 18, 19, and 26 are dependent upon claim 6, which the Applicant believes are allowable over the cited prior art of record for the same reasons provided above.

Shirakawabe fails to disclose or suggest all of the elements of any one of claims 16, 17, 18, 19, and 26. Further, Shirakawabe teaches away from the claimed invention. Based on the foregoing amendment and arguments, Applicant believes that the rejections are overcome and requests withdrawal of the 35 U.S.C. 103(a) rejection of claims 16, 17, 18, 19, and 26 over Shirakawabe.

Hong

The Action rejects claims 1, 4 – 6, 8, 13 – 19, 21, 26, 28 – 29, and 31 as obvious over U.S. patent 6,185,991 (Hong). Applicant traverses the rejection for at least the following reasons.

Claim 6, as amended, recites:

> A probe for use in an atomic force microscope, the probe comprising a tip and a beam, the tip having a tip radius of 100 nm or less, the beam having a first and second side and is coated on at least one of the first and second sides with a mechanical-energy dissipating polymer.

Underline added. Claim 16, as amended, recites:

> a probe having a ... beam ... at least a portion of the beam coated with a polymer and the polymer includes a rubber having a low cross-linking density... .

Underline added. And claim 29, as amended, recites:

> A method of collecting image data from a scan area of a sample with nanometric features wherein the method comprises the steps of:
>
> (a) moving a probe having a beam and a tip having a tip radius of 100 nm or less into close proximity with a sample in order to allow an interaction force to be established between probe and sample; the beam

having a first and second side and is coated on at least one of the first and second sides with a polymer, the polymer including one or more substance selected from the group consisting of i) rubber with low cross-linking density, and ii) a block copolymer material with a majority component that is an amorphous rubber with a glass transition temperature below room temperature and a minority component that is an amorphous polymer with a glass transition temperature above room temperature... .

Hong does not disclose or suggest a probe as recited in claims 6, 16, or 29, as quoted above. And as attested to the fact that the Action separately cites U.S. patent No. 6,330,824 (Erie) for a "polymer," the Action admits that Hong does not disclose or suggest all of the elements of any one of claims 6, 16, or 29, as amended.

Erie is separately addressed, below, in response to the rejection of claims 9, 10, 11, 12, and 27 over Hong in view of Erie.

Claims 1, 4 – 6, 8, 13 – 14 depend from and include all of the elements of claim 6. Claims 19, 21, 26, and 28 depend from and include all of the elements of claim 16. And claim 31 depends from and includes all of the elements of claim 29. Applicant believes these dependent claims are allowable over the cited prior art of record for the same reasons provided above.

Based on the foregoing amendment and arguments, Applicant believes that the rejections are overcome and requests withdrawal of the 35 U.S.C. 103(a) rejection of claims 1, 4 – 6, 8, 13 – 19, 21, 26, 28 – 29, and 31 over Hong.

Hong and Erie

The Action rejects claims 9, 10, 11, 12, and 27 as obvious over Hong in view of Erie. Claims 9, 10, and 27 are cancelled and their rejection is moot. The Action states: "Erie teaches (col. 6, lines 42-62) use of polymeric coatings for cantilevers requiring reflective surfaces for proper measuring with optics. Use of "polymers" is suggestive of trying any known polymer, as Erie is silent as to any specific polymers." Applicant traverses the rejection for at least the following reasons.

Erie teaches "A method of imaging a sample present in a solution by employing an atomic force microscope comprises providing an atomic force microscope having a cantilever... . The cantilever has at least one coating present thereon to absorb energy **such that the cantilever bends and vibrates**." Erie, Abstract, underline and bold added. Erie continues:

> As shown, the top side has at least one coating positioned thereon. In this embodiment, an absorbing coating 140 is present on the top surface 120 of the cantilever 100 and is generally intended to absorb light from the heating laser and reflect light from the detection laser. ... In this embodiment, coating 140 is in the form of a layer of black paint. Metals such as, for example, gold, palladium, silver, aluminum, and alloys thereof may also be used. Positioned on the absorbing coating 140 is a reflective coating 150 that allows for the selective reflection of light. As an example, the reflective coating may be formed from various metals and alloys thereof known in the art such as, for example, gold, aluminum, palladium, and silver. ...

Erie, column 6, lines 11 – 41. The first half of the passage cited by the Examiner repeats the purpose of the coating is to promote bending and vibration of the cantilever:

> In another embodiment illustrated in FIG. 7, a single coating may be present on top of the cantilever 170. .... The coating 170 should absorb light in sufficient quantities to induce bending and vibration of the cantilever.

Erie, column 6, lines 42 – 53. The reamaining portion of the passage cited by the Examiner states that the coating can include a dielectric coating in the form of polymers, magnesium fluoride, and mixtures thereof. Erie, column 6, lines 54 – 61.

On reading Erie, one of ordinary skill in the art would understand that Erie's cantilever beam may be coated with a light-reflecting layer or a photothermal absorbing layer. Examples of materials that may be used to provide the light-reflecting layer are "various metals and alloys thereof." That is, not a polymeric layer. Materials suitable for the energy-absorbing layer are "in the form of a layer of black paint. Metals such as, for example, gold, palladium, silver, aluminum and alloys thereof may also be used". Again, the energy-absorbing layer materials are not a polymeric layer.

The only layer for which a polymeric coating is taught is a dielectric coating that is present in addition to the reflective and absorbing coatings (col 6, lines 55 - 61). The examiner stated that the mere mention of a polymer is indicative of trying

all polymers. This cannot be the case as properties of the polymer of Erie must enhance the performance of either the reflective or absorbing layers, which are central to that invention.

The absorbing layer of Erie is designed to absorb heat energy and transfer it to the cantilever beam in order to stimulate its motion. By way of contrast the coating of the present invention is specifically intended dissipate mechanical energy. That is, the two coatings have completely opposite functions. One of ordinary skill in the art would immediately be led away from using an energy-dissipating coating on the cantilever disclosed by Erie simply because its effect would be to negate the function of the energy-absorbing layer, which is central to the invention described in Erie. Erie teaches away from a probe coated with a mechanical energy dissipating polymer.

Given the functions of the coatings disclosed in Erie, one of ordinary skill in the art would not conclude that a mechanical energy dissipating polymer could substitute for the Erie coatings. Although Erie states "polymer," the type of polymer disclosed is of a genus different than that described and claimed. Finally, assuming *arguendo* that the genus of Erie overlapped with Applicants claimed invention, a genus does not anticipate a species or render a species obvious.

The combination of Hong and Erie fails to disclose or suggest:

> a probe for use in an atomic force microscope, the probe comprising a tip and a beam, the tip having a tip radius of 100 nm or less, the beam having a first and second side and is coated on at least one of the first and second sides with a mechanical-energy dissipating polymer,

as recited in claim 6, as amended, underline added. Claims 11 and 12 depend from and include all of the elements of claim 6, as amended.

The combination of Hong and Erie fails to disclose or suggest:

> a probe having a ... beam ... at least a portion of the beam coated with a polymer and the polymer includes a rubber having a low cross-linking density...

as recited in claim 16, as amended, underline added.

Finally, with respect to the rejection of claim 29 over Hong, Applicant amended claim 29 to recite particular polymer coatings. The combination of Hong and Erie fail to disclose or suggest:

> A method of collecting image data from a scan area of a sample with nanometric features wherein the method comprises the steps of:
>
> (a) moving a probe having a beam and a tip having a tip radius of 100 nm or less into close proximity with a sample in order to allow an interaction force to be established between probe and sample; the beam having a first and second side and is coated on at least one of the first and second sides with a polymer, the polymer including one or more substance selected from the group consisting of i) rubber with low cross-linking density, and ii) a block copolymer material with a majority component that is an amorphous rubber with a glass transition temperature below room temperature and a minority component that is an amorphous polymer with a glass transition temperature above room temperature...

As recited in claim 29, as amended, underline added.

As set forth above, the combination of Hong and Erie fails to disclose or suggest all of the elements of any one of claims 11 or 12. Further, Erie teaches away from the claimed invention. Finally, the combination of Hong and Erie fails to teach or suggest all of the elements of any one of the pending claims.

Based on the foregoing amendment and arguments, Applicant believes that the rejections are overcome and requests withdrawal of the 35 U.S.C. 103(a) rejection of claims 11 and 12.

New Claims

The new claims are patentable over the cited prior art references, alone or in combination, for at least the reasons set forth above.

Conclusion

If the Examiner believes that any additional matters need to be addressed in order to place this application in condition for allowance, or that a telephone interview will help to advance the prosecution of this application, the Examiner is invited to contact the undersigned by telephone at the Examiner's convenience.

In view of the foregoing amendment and remarks, Applicants respectfully submit that the present application, including claims 1 – 6, 8, 11 – 23, 25 – 26, 28 – 29, and 31 – 46, is in condition for allowance and a notice to that effect is respectfully requested.

Respectfully submitted,

Humphris et al.

By /Douglas J. Bucklin/
Douglas J. Bucklin
Registration No. 51,208

Volpe and Koenig, P.C.
United Plaza, Suite 1600
30 South 17th Street
Philadelphia, PA 19103
Telephone: (215) 568-6400
Facsimile: (215) 568-6499

DJB/dmp
Enclosures